IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Ajay Kapur et al.	§	Group Art Unit: 2624
Serial No.: 10/692,450	§	Examiner: Wang, Claire X.
Filed: October 23, 2003	§	Confirmation No.: 8030
For: SYSTEMS AND METHODS FOR VIEWING AN ABNORMALITY IN DIFFERENT KINDS OF IMAGES	§	Atty. Docket: RD28357-1/YOD GERD:0220

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September 9, 2008	/John Rariden/
Date	John M. Rariden

APPEAL BRIEF PURSUANT TO 37 C.F.R. §§41.31 AND 41.37

This Appeal Brief is being filed in furtherance to the Notice of Appeal electronically filed on July 9, 2008.

The Commissioner is authorized to charge the requisite fee of $510.00, and any additional fees, which may be necessary to advance prosecution of the present application, to Account No. 07-0868, Order No. RD28357-1/YOD (GERD:0220).

1. REAL PARTY IN INTEREST

The real party in interest is General Electric Company, the Assignee of the above-referenced application by virtue of the Assignment to General Electric Company by Boris

Yamrom, Oliver Richard Astley, Ajay Kapur recorded at reel 015058, frame 0174, on March 10, 2004. Accordingly, General Electric Company, as the Assignee of the above-referenced application, will be directly affected by the Board's decision in the pending appeal.

2. RELATED APPEALS AND INTERFERENCES

Appellants are unaware of any other appeals or interferences related to this Appeal. The undersigned is Appellants' legal representative in this Appeal.

3. STATUS OF CLAIMS

Claims 1-26 are currently pending, are currently under final rejection and, thus, are the subject of this Appeal. Of the pending claims, claims 1-16 and 20-26 are currently rejected, and claims 17-19 are objected to.

4. STATUS OF AMENDMENTS

Appellants have not submitted any amendment subsequent to the Final Office Action mailed on March 20, 2008.

5. SUMMARY OF CLAIMED SUBJECT MATTER

The present application relates generally to imaging. *See* Application, page 1, paragraph 2. More particularly, in certain embodiments, the application relates to systems and methods for viewing an abnormality in different kinds of images. *See* Application, page 1, paragraph 2.

The Application contains five independent claims, namely, claims 1, 8, 12, 21 and 24. The subject matter of these claims is summarized below.

With regard to the aspect of the application set forth in independent claim 1, discussions of the recited features of claim 1 can be found at least in the below cited locations of the specification and drawings. By way of example, an embodiment in accordance with the present application relates to a method for viewing an abnormality (*e.g.*, 152) in different kinds of images. The method comprises scanning an object using a first imaging system (*e.g.*, 20) to obtain at least a first image of the object (*e.g.*, 152). *See, e.g., id.,* paragraphs 6, 7, 8-12, 45, 47, 53, 56, 57, 59, 68; *see also* FIGS. 1, 2, 5, 6, 7 and 11-15. The method also comprises determining coordinates of a region of interest (ROI) visible on the first image, wherein the ROI includes the abnormality. *See, e.g., id.,* paragraphs 7, 8-12, 53, 56, 58, 59, 60, 61, 62, and 66; *see also* FIGS. 1, 2, 5, 6, 7 and 11-15. The method further comprises using the coordinates of the ROI to scan the object with a second imaging system (*e.g.*, 14). *See, e.g., id.,* paragraphs 7, 8-12, 39, 52, 56, 58, 64; *see also* FIGS. 1, 2, 5, 6, 7 and 11-15.

With regard to the aspect of the application set forth in independent claim 8, discussions of the recited features of claim 8 can be found at least in the below cited locations of the specification and drawings. By way of example, an embodiment in accordance with the present application relates to a system (*e.g.*, 150) for viewing an abnormality (*e.g.*, 152) in different kinds of images. The system comprises an X-ray imaging system (*e.g.*, 20) configured to scan an object to obtain at least one X-ray image of the object (*e.g.*, 158) *See, e.g., id.,* paragraphs 6, 7, 8-12, 45, 47, 53, 56, 57, 59, 68; *see also* FIGS. 2, 7 and 11-15. The system also comprises a controller (*e.g.*, 40) configured to determine coordinates of a region of interest (ROI) visible on the first image, the ROI including the abnormality; and utilize the coordinates of the ROI to scan the object with an ultrasound imaging system (*e.g.*, 14). *See, e.g., id.,* paragraphs 9, 12, 33, 34, 47, 51, 54; *see also* FIGS. 2, 7 and 11-15.

With regard to the aspect of the application set forth in independent claim 12, discussions of the recited features of claim 12 can be found at least in the below cited locations of the specification and drawings. By way of example, an embodiment in accordance with the present application relates to a method for viewing an abnormality (*e.g.*, 152) in different kinds of images. The method comprises determining coordinates of a region of interest (ROI) visible on an image obtained using a first imaging system (*e.g.*, 20), the ROI including the abnormality. *See, e.g., id.,* paragraphs 23-34; *see also* FIGS. 2 and 4. The method also comprises utilizing the coordinates of the ROI to scan the object with a second imaging system different from the first imaging system (*e.g.*, 200). *See, e.g., id.,* paragraphs 7, 8-12, 53, 56, 58, 59, 60, 61, 62, and 66; *see also* FIGS. 1, 2, 5, 6, 7 and 11-15. The method further comprises registering 3-dimensional (3D) data relative to 2-dimensional (2D) data, wherein the 3D data is obtained using the second imaging system (*e.g.*, 14) and the 2D data is obtained using the first imaging system. *See, e.g., id.,* paragraphs 7, 8-12, 39, 52, 56, 58, 64; *see also* FIGS. 1, 2, 5, 6, 7 and 11-15.

With regard to the aspect of the application set forth in independent claim 21, discussions of the recited features of claim 21 can be found at least in the below cited locations of the specification and drawings. By way of example, an embodiment in accordance with the present application relates to a method for viewing an abnormality (*e.g.*, 152) in different kinds of images. The method comprises scanning an object using an X-ray imaging system (*e.g.*, 20) to obtain at least one X-ray image of the object (*e.g.*, 158). *See, e.g., id.,* 6, 7, 8-12, 45, 47, 53, 56, 57, 59, 68; *see also* FIGS. 2, 7 and 11-15. The method also comprises determining coordinates of a region of interest (ROI) on the X-ray image, wherein the ROI includes the abnormality. *See, e.g., id.,* paragraphs 7, 8-12, 53, 56, 58, 59, 60, 61, 62, and 66; *see also* FIGS. 1, 2, 5, 6, 7 and 11-15. The method further comprises instructing a probe mover to move a probe to the coordinates to scan a specific region of the object, wherein the specific region is defined by the coordinates. *See, e.g., id.,* paragraphs 7, 8-12, 39, 52, 56, 58, 64; *see also* FIGS. 1, 2, 5, 6, 7 and 11-15.

The method further comprises instructing an ultrasound imaging system to scan the specific region of the object to obtain at least one ultrasound image (*e.g.*, 14). *See, e.g., id.,* paragraphs 7, 8-12, 39, 52, 56, 58, 64; *see also* FIGS. 1, 2, 5, 6, 7 and 11-15.

With regard to the aspect of the application set forth in independent claim 24, discussions of the recited features of claim 24 can be found at least in the below cited locations of the specification and drawings. By way of example, an embodiment in accordance with the present application relates to a system (*e.g.*, 150) for viewing an abnormality (*e.g.*, 152) in different kinds of images. The system comprises an X-ray imaging system (*e.g.*, 20) configured to scan an object to obtain at least one X-ray image of the object (*e.g.*, 158) *See, e.g., id.,* paragraphs 6, 7, 8-12, 45, 47, 53, 56, 57, 59, 68; *see also* FIGS. 2, 7 and 11-15. The system also comprises a controller (*e.g.*, 40) configured to determine coordinates of a region of interest (ROI) visible on the X-ray image, the ROI including the abnormality; utilize the coordinates of the ROI to scan the object with an ultrasound imaging system (*e.g.*, 14); and register 2-dimensional (2D) data from which the X-ray image is generated with 3-dimensional (3D) data obtained by scanning the object with the ultrasound imaging system. *See, e.g., id.,* paragraphs 9, 12, 33, 34, 47, 51, 54; *see also* FIGS. 2, 7 and 11-15.

A benefit of the application, as recited in these claims, resides in systems and methods for viewing an abnormality in different kinds of images. *See, e.g., id.,* paragraphs 2, 8-12, 54, 55, 58, and 68.

6. <u>GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL</u>

<u>First Ground of Rejection for Review on Appeal</u>

Whether the Examiner has established a *prima facie* case of obviousness of claims 1-6, 8-15, and 20-25 under 35 U.S.C. §103(a) as being unpatentable over Leichter et al. (U.S. Patent Application Number 2004/0086158, hereinafter "Leichter") in view of Wang et al. (U.S. Patent Application Number 2003/0007598, hereinafter "Wang").

<u>Second Ground of Rejection for Review on Appeal</u>

Whether the Examiner has established a *prima facie* case obviousness of claims 7, 16, 20 and 26 under 35 U.S.C. §103(a) as being unpatentable over Leichter in view Wang further in view of Fu et al. (U.S. Patent Application Number 2005/0047544, hereinafter "Fu").

7. ARGUMENT

As discussed in detail below, the Examiner has failed to establish a *prima facie* case of obviousness for the pending claims. In particular, the Examiner has misapplied long-standing and binding legal precedents and principles in rejecting the claims under Section 103. Accordingly, Appellants respectfully request full and favorable consideration by the Board, as Appellants assert that claims 1-26 are currently in condition for allowance.

A. Ground of Rejection No. 1:

The Examiner rejected claims 1-6, 8-15, and 20-25 under 35 U.S.C. §103(a), as being unpatentable over Leichter in view of Wang. Of these claims, claims 1, 8, 12, 21 and 24 are independent and will be discussed in detail below. Claims 2-6 depend from independent claim 1; claims 9-11 depend from independent claim 8; claims 13-15 and 20 depend from independent claim 12; claims 22-23 depend from independent claim 21; and claim 25 depends from independent claim 24 and will also be discussed in detail below.

<u>Claims 1, 8, 12, 21 and 24 and claims depending therefrom</u>

Claim 1 recites a method for viewing an abnormality in different kinds of images. The method includes scanning an object using a *first imaging system to obtain at least a first image of the object*; determining coordinates of a *region of interest (ROI) visible on the first image, wherein the ROI includes the abnormality; and using the coordinates of the ROI to scan the object with a second imaging system.*

Claim 8 similarly recites a system for viewing an abnormality in different kinds of images. Again, The system includes an X-ray imaging system configured to scan an object to obtain *at least one X-ray image of the object* and a controller configured to determine coordinates of a *region of interest (ROI) visible on the first image*, *the ROI including the abnormality; and to utilize the coordinates of the ROI to scan the object with an ultrasound imaging system.*

Claim 12, recites a method for viewing an abnormality in different kinds of images. The method includes determining coordinates of a *region of interest (ROI) visible on an image obtained using a first imaging system, the ROI including the abnormality; and utilizing the coordinates of the ROI to scan the object with a second imaging system.*

Claim 21 also recites a method for viewing an abnormality in different kinds of images. The method similarly includes scanning an object using an X-ray imaging system to obtain *at least one X-ray image of the object*; determining coordinates of a *region of interest (ROI) on the X-ray image, wherein the ROI includes the abnormality; instructing a probe mover to move a probe to the coordinates to scan a specific region of the object, wherein the specific region is defined by the coordinates; and instructing an ultrasound imaging system to scan the specific region of the object to obtain at least one ultrasound image.*

Finally, claim 24 recites a system for viewing an abnormality in different kinds of images. The system similarly includes an X-ray imaging system configured to scan an object to obtain *at least one X-ray image of the object*; and a controller configured to determine coordinates of *a region of interest (ROI) visible on the X-ray image, the ROI including the abnormality; and to utilize the coordinates of the ROI to scan the object with an ultrasound imaging system.*

Leichter fails to teach the recited subject matter.

In the "Claim Rejections" section, on page 4 of the Final Office Action, the Examiner stated that Leichter teaches scanning an object using a first imaging system to obtain at least a first image of the object; and determining coordinates of a region of interest (ROI) visible on the first image, wherein the ROI includes the abnormality. The Examiner, in rejecting the present independent claims, concedes that the Leichter reference "does not teach using the coordinates of the ROI to scan the object with a second imaging system." Final Office Action, p. 4, section 5. Instead, the Examiner relied on the Wang reference as disclosing "using the coordinates of the ROI in one system for a second imaging system." Final Office Action, pp. 4-5, section 5. Thus, the Examiner's *prima facie* case relies upon the Wang reference as showing the use of coordinates of a ROI obtained from images generated by a first imaging system to scan the object with a second imaging system. Absent a showing by the Wang reference, no *prima facie* case of obviousness exists with regard to the present independent claims.

In support of his position, the Examiner relies upon paragraph [0044], lines 5-8 of the Wang reference and stated that the Wang reference teaches a breast cancer screening system that uses both X-ray mammograms and ultrasound. The Examiner further stated that Wang's system performs a CAD algorithm that corresponds the ROI in the X-ray mammogram view with the ultrasound view and thus, Wang reads on the claimed using the coordinates of the ROI in one system for second imaging system. The Examiner goes on to state that it would have been obvious to one skilled in the art to at the time of the invention was made to combine Leichter' X-ray display system with Wang's second view using an ultrasound viewing system in order to promote volumetric thoroughness of the scan.

The relied upon passage of the Wang reference, i.e., paragraph [0044], reads:

> According to another preferred embodiment, a breast cancer screening CAD system is provided that performs a first set of CAD algorithms on a digitized x-ray mammogram view of the breast, performs a second set of CAD algorithms on a corresponding set of adjunctive ultrasound views, correlates regions of interest (ROIs) between the x-ray mammogram view and the adjunctive ultrasound views, and performs joint classification of the ROI using both the x-ray CAD results and the ultrasound CAD results. During the ROI correlation process, ROIs in the x-ray mammogram are matched to corresponding ROIs in the adjunctive ultrasound views in a manner that obviates the need for complex registration computations. Rather, a simplified but statistically reliable lesion-centric correlation process using nipple distance information, or using a combination of nipple distance information and nipple angle information, is used to match corresponding ROIs in the x-ray mammogram view and the adjunctive ultrasound views. In another preferred embodiment, the correlation process also uses lesion size as a factor in matching corresponding regions of interest in the x-ray mammogram view and the adjunctive ultrasound views. In still another preferred embodiment, the correlation process uses lesion distance from the chest wall as a factor in matching corresponding regions of interest in the x-ray mammogram view and the adjunctive ultrasound views. In one preferred embodiment, the joint classification algorithm comprises a direct addition of scalar suspiciousness metrics taken from the x-ray CAD results and the ultrasound CAD results.
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> Wang, paragraph 44. Emphasis added.

Thus, contrary to the present independent claims which generally recite the use of the coordinates of the ROI obtained from a first imaging system to scan an object with a second imaging system, the Wang reference instead appears to disclose the independent acquisition of images using first and second imaging systems. In particular, the Wang reference appears to disclose the identification of a ROI identified in two previously

<u>acquired</u> images, i.e., information obtained in one image is <u>not</u> used in the acquisition of the second image. As noted by the emphasized text in the reproduced passage, the Wang reference merely appears to disclose that two images are each processed by a CAD algorithm to "correlate" regions of interest within the images and to perform "joint classification" of the regions of interest. None of this, however, equates to using coordinates obtained in an image obtained with one modality to direct the <u>acquisition</u> of images using a second modality.

Further, despite maintaining the rejection, the Examiner appears to explicitly recognize this deficiency of the Wang reference. In particular, in the Advisory Action the Examiner states that "Wang teaches the three-dimensional features are located and extracted from the three-dimensional volumetric representation of the breast volumn [sic] in a manner that takes advantage of knowledge of the two-dimensional ROIs (Paragraph [0152], lines 8-13)." Advisory Action p. 2. Thus, the Examiner's understanding of this passage of the Wang reference appears to be that features are <u>located</u> and <u>extracted</u> from an <u>existing</u> volumetric representation based on knowledge of the two-dimensional ROIs. Obviously <u>locating</u> and <u>extracting</u> <u>features</u> from an existing volumetric representation is not the same thing as <u>acquiring</u> an <u>image</u> or <u>volume</u> and instead appears to be consistent with Appellants' understanding of the Wang reference.

Further, this view is reinforced by reference to FIG. 20A of the Wang reference (which the passage relied upon by the Examiner describes) which depicts slice images 2002 and breast volume 2016 as <u>starting points</u> for the joint feature extraction process, i.e., the images 2002 and volume 2016 exist <u>prior to</u> extraction of the ROIs at steps 2004 and 2018, thus contradicting any assertion that coordinates or location of the ROIs in one image are used to acquire the second image. Indeed, the entire passage in context reads:

> FIG. 20A illustrates steps for computer-aided diagnosis (CAD) of adjunctive ultrasound data according to a preferred embodiment. Thick-slice image acquisition (step 2002), ROI location (step 2004), segmentation (step 2006), extraction of conventional two-dimensional features (step 2008), and extraction of two-dimensional acoustical features (step 2014) proceed in a manner similar to steps 1902-1908 and 1914 of FIG. 19, respectively. Additionally, however, three-dimensional features are located and extracted from the three-dimensional volumetric representation of the breast volume in a manner that takes advantage of knowledge of the two-dimensional ROIs located in the thick-slice images at step 2004. At step [2016][1], the three-dimensional volumetric representation of the breast already exists by virtue of its computation from the initial raw ultrasound scans as part of the individual ultrasound slice generation process. At step 2018, ROIs are located in the thick-slice volume according to a method that takes advantage of the known two-dimensional ROI locations computed for the thick-slice images. For a given thick-slice image, there is a corresponding thick-slice volume contained in the three-dimensional volumetric representation of the breast. According to a preferred embodiment, the two-dimensional ROIs (x, z) found in that slick-slice image may be used as starting points in locating three-dimensional ROI locations (x, y, z) within that thick-slice volume. This can save computing time by reducing the ROI search to a one-dimensional search in the "y" direction for each (x, z) starting point.
>
> Wang, paragraph 152. Emphasis added.

Thus, the passage relied upon by the Examiner in attempting to refute Appellants arguments, the figure described by the relied upon passage, and the Examiner's description of the contents of the passage all refute the Examiner's actual position and instead reinforce the position maintained by the Appellants.

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[1] The passage references a step 2061, however, no such reference number is evident in FIG. 20A. However, reference number 2016 references the breast volume acquisition, which is what appears to be described in

Therefore, the Wang reference does not teach that information (such as location or coordinates) about a region of interest identified in an image acquired using a first imaging system are used in the operation of a second imaging system. As a result, the Wang reference does not obviate the deficiencies of the Leichter reference. Thus, no *prima facie* case of obviousness has been established by the Examiner for the present independent claims 1, 8, 12, 21 and 24 or those claims depending therefrom.

B. <u>Ground of Rejection No. 2</u>:

The Examiner rejected claims 7, 16, 20 and 26 under 35 U.S.C. §103(a) as being unpatentable over Leichter in view Wang further in view of Fu. Of the remaining pending claims, rejected dependent claim 7 depends from independent claim 1; dependent claims 16 and 20 depend from independent claim 12; and claim 26 depends from independent claim 24.

Appellants respectfully state that as has been described in details above with regards to Ground of Rejection No. 1 rejection, the Leichter reference fails to teach scanning an object using a first imaging system to obtain at least a first image of the object; determining coordinates of a region of interest (ROI) visible on the first image, wherein the ROI includes the abnormality; and using the coordinates of the ROI to scan the object with a second imaging system and the Wang reference fails to obviate the deficiencies in the teachings of the Leichter reference.

The Fu reference similarly fails to obviate the deficiencies in the teachings of the Leichter reference. Specifically, the Fu reference fails to disclose *determining coordinates of a region of interest (ROI)* visible on the first image, wherein the ROI includes the abnormality; or *using the coordinates of the ROI to scan the object with a second imaging system* as generally set forth in claims 1, 8, 12, 21 and 24.

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this passage. Therefore, we assume that the reference number 2061 is a typographical error and that the reference number 2016 was intended.

In the "Claim Rejections" section, on page 10 of the Final Office Action, the Examiner stated that "Leichter does not teach wherein registering 2D data from which the first image is generated with 3D data comprises:obtaining at least six equations having at least six unknowns, wherein each equation establishes a relationship between coordinates of 2D data acquired from the first imaging system and coordinates of 3D data acquired from the second imaging system; and solving the six equations to obtain the six unknowns." Final Office Action, p. 10. The Examiner relied on the Fu reference solely for the disclosure of "the claimed [six] unknowns." Final Office Action, p. 10.

The Appellants respectfully note that, the Fu reference does not teach or disclose that information (such as location or coordinates) about a region of interest identified in an image acquired using a first imaging system are used in the operation of a second imaging system. Further, the Examiner does not assert that the Fu reference addresses these deficiencies of the Leichter reference. Therefore, any combination of the Leichter, Wang and Fu references fails to establish a *prima facie* case of obviousness with respect to independent claims 1, 8, 12, 21 and 24, from which the present claims depend. Consequently, the present dependent claims are allowable at least by virtue of their dependency from an allowable base claim. Thus, it is respectfully requested that the rejection of these claims under 35 U.S.C. §103(a) be withdrawn.

Conclusion

In view of the remarks and amendments set forth above, Appellants respectfully request allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

Date: September 9, 2008

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8. APPENDIX OF CLAIMS ON APPEAL

1. A method for viewing an abnormality in different kinds of images, said method comprising:

scanning an object using a first imaging system to obtain at least a first image of the object;

determining coordinates of a region of interest (ROI) visible on the first image, wherein the ROI includes the abnormality; and

using the coordinates of the ROI to scan the object with a second imaging system.

2. A method in accordance with Claim 1 wherein determining coordinates of the ROI visible on the first image comprises manually marking the ROI on a display device that displays the first image.

3. A method in accordance with Claim 1 wherein determining coordinates of the ROI visible on the first image comprises automatically marking the ROI by using a computer-aided diagnosis (CAD) algorithm.

4. A method in accordance with Claim 1 wherein using the coordinates of the ROI to scan the object with a second imaging system comprises:

instructing a probe mover to move a probe to the coordinates to scan a specific region of the object, wherein the specific region is defined by the coordinates; and

scanning the specific region of the object with the second imaging system to obtain at least one second image.

5. A method in accordance with Claim 4 further comprising displaying the first and the second images concurrently to enable a user to view the abnormality.

6. A method in accordance with Claim 1 further comprising registering 2-dimensional (2D) data from which the first image is generated with 3-dimensional (3D) data obtained by scanning the object with the second imaging system.

7. A method in accordance with Claim 6 wherein registering 2D data from which the first image is generated with 3D data comprises:

obtaining at least six equations having at least six unknowns, wherein each equation establishes a relationship between coordinates of 2D data acquired from the first imaging system and coordinates of 3D data acquired from the second imaging system; and

solving the six equations to obtain the six unknowns.

8. A system for viewing an abnormality in different kinds of images, said system comprising:

an X-ray imaging system configured to scan an object to obtain at least one X-ray image of the object; and

a controller configured to:

determine coordinates of a region of interest (ROI) visible on the first image, the ROI including the abnormality; and

utilize the coordinates of the ROI to scan the object with an ultrasound imaging system.

9. A system in accordance with Claim 8 wherein to determine coordinates of the ROI visible on the X-ray image the controller is configured to enable manual marking of the ROI on a display device that displays the first image.

10. A system in accordance with Claim 8 wherein to determine coordinates of the ROI visible on the X-ray image the controller is configured to mark the ROI by using a computer-aided diagnosis (CAD) algorithm.

11. A system in accordance with Claim 8 wherein to utilize the coordinates of the ROI to scan the object with the ultrasound imaging system the controller is configured to:

instruct a probe mover to move a probe to the coordinates to scan a specific region of the object, wherein the specific region is defined by the coordinates; and

instruct the ultrasound imaging system to scan the specific region of the object to obtain at least one ultrasound image.

12. A method for viewing an abnormality in different kinds of images, said method comprising:

determining coordinates of a region of interest (ROI) visible on an image obtained using a first imaging system, the ROI including the abnormality;

utilizing the coordinates of the ROI to scan the object with a second imaging system different from the first imaging system; and

registering 3-dimensional (3D) data relative to 2-dimensional (2D) data, wherein the 3D data is obtained using the second imaging system and the 2D data is obtained using the first imaging system.

13. A method in accordance with Claim 12 wherein registering 3D data relative to 2D data comprises registering 3D data relative to 2D data without using fiducial marks on a patient having the abnormality.

14. A method in accordance with Claim 12 wherein registering 3D data relative to 2D data comprises registering 3D data acquired using an ultrasound imaging system relative to 2D data acquired using an X-ray imaging system.

15. A method in accordance with Claim 14 further comprising establishing a relationship between the 3D data acquired using the ultrasound imaging system and the 2D data acquired using the X-ray imaging system.

16. A method in accordance with Claim 12 wherein registering 3D data relative to 2D data comprises:

obtaining at least six equations having at least six unknowns, wherein each equation establishes a relationship between coordinates of 2D data acquired from an X-ray imaging system and coordinates of 3D data acquired from an ultrasound imaging system; and

solving the six equations to obtain the six unknowns.

17. A method in accordance with Claim 16 wherein three of the six equations are $x1x1\text{-}q1 = r1(c1x1u1 + t1 - q1)$, $y1x1\text{-}q2 = r1(c2y1u1 + t2 - q2)$, and $z1x1\text{-}q3 = r1(c3z1u1 + t3 - q3)$, wherein $(x1,y1,z1)$ are coordinates in a first coordinate system of a first datum acquired using the ultrasound imaging system, $(x1u1,y1u1,z1u1)$ are coordinates in a second coordinate system of the first datum, $(q1,q2,q3)$ are coordinates of a center of projection S at which an X-ray source of the X-ray imaging system is positioned to project the first datum on to a plane from the center of projection, r1, c3, t1, t2, and t3 are five of the six unknowns, c1 is a length in an along an X-axis of a pixel of a 2D image generated from data acquired using the ultrasound imaging system, and c2 is a length in an along a Y-axis of the pixel of the 2D image generated from data acquired using the ultrasound imaging system.

18. A method in accordance with Claim 17 further comprising:

selecting the first datum and its projection on to the plane by:

viewing an extreme point at a boundary of a feature within an X-ray image generated using the X-ray imaging system;

viewing a 2D slice of data obtained using the ultrasound imaging system, wherein the 2D slice is orthogonal to a plane of the X-ray image; and

relocating the 2D slice to visualize the object for a first time in the 2D slice, wherein the extreme point is the projection of the first datum.

19. A method in accordance with Claim 17 wherein the remaining three of the six equations are x2x2-q1 = r2(c1x2u2 + t1 – q1), y2x2-q2 = r2(c2y2u2 + t2 – q2), and z2x2-q3 = r2(c3z2u2 + t3 – q3), wherein (x2,y2,z2) are coordinates in the first coordinate system of a second datum acquired using the ultrasound imaging system, (x2u2,y2u2,z2u2) are coordinates in the second coordinate system of the second datum, and r2 is the sixth unknown.

20. A method in accordance with Claim 16 further comprising:

obtaining six additional equations having six additional unknowns, wherein each of the six additional equations establishes a relationship between coordinates of 2D data acquired from the X-ray imaging system and coordinates of 3D data acquired from the ultrasound imaging system;

solving the six additional equations to obtain the six additional unknowns; and

averaging a first unknown of the six unknowns with a corresponding first additional unknown of the six additional unknowns.

21. A method for viewing an abnormality in different kinds of images, said method comprising:

scanning an object using an X-ray imaging system to obtain at least one X-ray image of the object;

determining coordinates of a region of interest (ROI) on the X-ray image, wherein the ROI includes the abnormality;

instructing a probe mover to move a probe to the coordinates to scan a specific region of the object, wherein the specific region is defined by the coordinates; and

instructing an ultrasound imaging system to scan the specific region of the object to obtain at least one ultrasound image.

22. A method in accordance with Claim 21 wherein determining coordinates of the ROI on the X-ray image comprises manually marking the ROI on a display device that displays the X-ray image.

23. A method in accordance with Claim 21 wherein determining coordinates of the ROI on the X-ray image comprises automatically marking the ROI by using a computer-aided diagnosis (CAD) algorithm.

24. A system for viewing an abnormality in different kinds of images, said system comprising:

an X-ray imaging system configured to scan an object to obtain at least one X-ray image of the object; and

a controller configured to:

determine coordinates of a region of interest (ROI) visible on the X-ray image, the ROI including the abnormality;

utilize the coordinates of the ROI to scan the object with an ultrasound imaging system; and

register 2-dimensional (2D) data from which the X-ray image is generated with 3-dimensional (3D) data obtained by scanning the object with the ultrasound imaging system.

25. A system in accordance with Claim 24 wherein to utilize the coordinates of the ROI to scan the object with the ultrasound imaging system the controller is configured to:

instruct a probe mover to move a probe to the coordinates to scan a specific region of the object, wherein the specific region is defined by the coordinates; and

instruct the ultrasound imaging system to scan the specific region of the object to obtain at least one ultrasound image.

26. A system in accordance with Claim 24 wherein to register 2D data from which the X-ray image is generated with 3D data the controller is configured to:

obtain at least six equations having at least six unknowns, wherein each equation establishes a relationship between coordinates of the 2D data acquired from the X-ray imaging system and coordinates of the 3D data acquired from the ultrasound imaging system; and

solve the six equations to obtain the six unknowns.

9. **EVIDENCE APPENDIX**

None.

10. **RELATED PROCEEDINGS APPENDIX**

None.